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ABSTRACT

Instructional implications of cognitive development theory are discussed, and it is proposed that the current theoretical framework offers a view of development that, applied in instructional contexts, leads to a reconceptualization of the traditional notion of developmental curricula. Piaget's theory offered a framework for how children should be taught and for what should be taught. It suggested to educators that learning across subject areas is interconnected and proceeds according to a developmental schedule. However, the promise that instructional sequences in the various disciplines could be integrated has never been fulfilled. New approaches that teach the components of the central conceptual structures and relations among them offer promise of coordinating instruction across subject areas. Current theory proposes to track conceptual understanding and interdisciplinary units. The current approach also allows teachers to make decisions regarding the timing of instruction on the basis of students' conceptual understanding. Students apply a given structure independently only when that structure is firmly in place. The present approach represents a move away from the Piagetian notion of a context-free, single, logical structure. A range of teaching approaches can be accommodated, and students' performance is judged in terms of their levels of understanding. One figure illustrates the central social structure, and there is a 14-item list of references. (SLD)

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Program Development Criteria for Curricula Designed to Teach Central Conceptual Structures

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Program Development Criteria for Curricula Designed to Teach Central Conceptual Structures

In this paper I discuss the instructional implications of cognitive developmental theory and propose that the current theoretical framework offers a view of development, which when applied in instructional contexts, leads to a reconceptualization of the traditional notion of developmental curricula and, indeed, of curricula, in general.

When Piaget's theory of child development was first introduced to North America, educators saw it as suggesting a new teaching methodology and a new approach to curriculum design. Piaget described the child as a "little scientist" who assembled increasingly complex knowledge structures largely through the internally-situated processes of, for example, exploration, problem solving, and conflict resolution. This view was in marked contrast to the then popular stimulus/response notions of the Behaviorists who held that learning was accounted for by environmentally-situated processes such as modeling and reinforcement. Instead of this teacher-directed instruction, a child-centered approach was advocated by Piagetian proponents. Because children were seen as "knowledge constructors," the preferred approach involved encouraging children to explore and interact with rich, developmentally-appropriate environments. For example, in teaching science, the teachers' role was to provide a learning environment where children's existing knowledge structures were challenged and they were encouraged to "discover" principles.

Questioning and problem solving activities focused children's natural tendencies to explore and offered them opportunities to assimilate information into existing cognitive structures as well as to construct higher-order structures. In effect, Piaget's psychological theory was a natural companion to Dewey's philosophy of education

Piaget's theory offered a new framework not only for *how* children should be taught, but additionally, for *what* should be taught and *when* it should be presented. The theory suggested that the logical structures underlying concepts such as conservation were very general ones, which if fostered indirectly should generalize to other structurally related tasks. The goal of the curricula designer, working within a Piagetian framework, was to develop programs of instruction built around these concepts. In keeping with Piaget's genetic epistemology, these curricula were stage sensitive. In other words, material bases on concrete operations was taught during the elementary school years and that based on formal operation was taught during junior and senior high school.

What ultimately was lacking from this approach, however, was a methodology for getting formal operations in place. The theory held that, although the logical structures were very difficult to teach, if taught they were expected to produce wide generalization. Studies actually found that a concept such as conservation could be taught without undue difficulty, at least above the age of 5 years. However, when it was taught, generalization was limited to other conservation tasks, but never occurred when the tasks' only relation was that they

shared the same underlying logical structure. (See Halford, 1982 for a review). As a consequence, the notion that the logical structures impacted on performance in a general way was challenged and, in its place a more constrained application was hypothesized. In grade schools, curriculum designed to foster the development of logical structures was, for the most part, limited to the discipline of science where the subject matter dealt directly with topics such an conservation and where processes such as exploration and problem solving were traditional methods of inquiry. Application of the instruction principles in non-scientific subject areas, such as history and English literature was largely lacking.[1]

For those who were interested in teaching the basic concepts and skills with which schools have traditionally been concerned, the theory that was being developed by information processing psychologists appeared to offer a much more promising alternative. By breaking skills into subskills, and general theoretical concepts into interrelated sets of subconcepts, it was possible to order material within any domain in a logical fashion, and be quite specific both as to what should be taught, and in what order. From the perspective of developmental theory, the view of children's learning that was implied was a good deal too passive, and fragmented into different disciplines or topics. Still, it must be admitted that, as a vehicle for planning and/or revising existing curricula, the new technology was impressive.

Individuals who adopted this approach, in general, held a view of

[1]The effort of Biggs & Collis (1982), in the SOLO taxonomy was a notable exception. However, it did not make a major impact on teaching practice, at least in North America.

learning that asserted that separate skills or concepts were learned relatively independently of each other, and that methods of inquiry and problem solving varied according to the discipline. Although teacher education programs continued to include course in child development by way of background knowledge, then, it is only in early childhood education where the Piagetian perspective achieved a dominant status.[2] Given the high activity level of children in the preschool years, and the fact that subject matter goals are not as yet very prominent, it is not surprising that this was the case. Still, for those who are attracted to Piaget's theory as an epistemological system, the current state of affairs is somewhat disappointing.

As was discussed in the first paper, however, the notion of organizing cognitive structures has not been totally abandoned. In what follows I discuss some of the implications this new view may hold for curriculum development, and teaching practice. My discussion is in no way exhaustive. Rather, it outlines some possible suggestions for how the approach might be utilized in an instructional context, based on the research I have been conducting on students' narratives.

What should be taught. Piagetian theory suggested to educators that learning across subject areas is interconnected and proceeds according to a developmental schedule. In other words, it held out the promise that instructional sequences in the various disciplines could be integrated. This promise was not fulfilled, however. The

[2]The teacher education program at Berkeley appears to be an exception, but it is an exception that proves the rule, since it is based on an attempt to operationalize Piagetian constructs differently in different subject matter domains.

current framework offers considerably more hope in this regard. Specifically, by teaching the components of the central conceptual structures, and the relations among them, we are in a good position to coordinate instruction across subject areas. Thus, we propose to teach: a) conceptual understanding and b) interdisciplinary units.

(a) Conceptual Understanding. Consider the findings reported in the preceding paper by Sharon Griffin. She demonstrated that pre-school "readiness" instruction based on the "number line" not only produced improvement in number knowledge, but additionally in tasks traditionally thought to be unrelated (e.g., distributive justice). Griffin concluded that the central dimensional structure can serve as a conceptual framework for curriculum modules. An immediate question that arises from her findings, however, involves the degree to which this type of effect will hold up across conceptual structures and grade levels. In other words, can the notion of central conceptual structures be used profitably in curriculum design beyond training math "readiness?" My own work addresses this question directly. Using the social structure discussed in the first paper, I developed a program of instruction for the same age group and got results similar to those reported by Griffin. That is, children not only showed improvement on criteria related measures, but demonstrated strong transfer to tasks that differed in surface features but shared a common conceptual underpinning, as well. With this knowledge in hand, our next goal was to determine if the construct could be applied across a wide range of grade levels.

To this end, we have analyzed students' performance throughout the elementary and high school years on various social tasks, and have identified three qualitatively distinct social structures, which map onto major school division splits. These central social structures are: (1) A scripted event structure (pre-school), in which human actions cohere by virtue of their causal, referential and temporal relations. (2) An intentional structure (elementary grades 1-6), in which people's actions are tied together by the mental states, such as desires and feelings, that underlie them. (3) An interpretive structure (junior/senior high school grades 7-12), in which the relations among an individual's actions and mental states are established on the basis of long standing psychological traits and personal history (Case & McKeough, 1991; McKeough, 1987, 1992) (see Figure 1).

When the narrow domain of narrative comprehension and composition was examined, a similar conceptual picture emerged (again, see Figure 1). The "story line" developed during the preschool years follows a simple event time line. Throughout the elementary school aged years the story line takes on the organization of a folktale, where the protagonist faces problematic situations that are eventually overcome. These situations are problematic because of the mental states they engender in the protagonist, in that they initiate a problematic state of affairs that must be over come.

At the high school level, the interpretative structure allows the student to take a meta-position to the intentions underlying actions. When interpreting fictional events in a short story or novel, students are able to go beyond the the immediate reason for the action, to

analyze the story, and to generalize the outcome to other situations (Applebee, 1978). When interpreting "family stories" (i.e., stories dealing with noteworthy events that have been told repeatedly by members of the family), average to high average adolescents, aged 12 years, reflect on the meaning the family history holds for them, whereas later in adolescence (i.e., at 18 years), students extract truths about life that can be generalized across situations and individuals. In both cases, the "long shadow of the past" is cast on the present and so affects how current actions and feelings are understood (Salter, in preparation).

It should be noted that analyses of this sort typically show individual differences both within individual children (i.e., a given student might perform at level "X" on one task and at level"X+1" on another) and across children (i.e., not all students at a given age level perform similarly on the various tasks). This pattern of performance reflects the widely accepted belief that formal learning opportunities are essential to the development of advanced thinking. For this reason, we have focused on the need to develop programs of instruction designed to encourage students to bring their conceptual knowledge to bear across domains. We suggest that one way to achieve this latter goal is through the development of interdisciplinary units.

(b) Interdisciplinary Units. It seem reasonable that the same students who take a meta-position to the intentions of fictional characters can be expected to interpret the motives of historical

characters and groups. Although as yet untested empirically in high school, instruction in the interpretive structure might well be used across traditional subject boundaries, for example, in English literature and history.[3] For example, students who reach an understanding of why the parents of Romeo and Juliet forbade the marriage can be expected to comprehend why the Jesuits thought that the Huron and Algonquin nations were uncivilized. In both cases, students take, as the "object" of their cognition, the mental states of the target groups (i.e., what they thought, felt, and wanted) and interpret these in light of the personal histories of the actors. In other words, both tasks require students to consider *why* the actors' perspectives developed as they did. By focusing on the components of the central conceptual structure and the semantic relations among them, instructors cross traditional discipline boundaries. Thus, teachers of both history and English literature are able to tap into the same conceptual understanding and so, develop interdisciplinary units in which they set similar goals (i.e., the construction and utilization of the interpretive structure), in a genuinely collaborative effort.

How central conceptual curricula should be taught. How might this notion of a central conceptual understanding be embodied in instructional practice? To answer this question, I will draw upon my

[3]Traditionally, efforts at transdisciplinary teaching in these two subject areas have involved dealing with a similar time frame and linking the political or economic issues of the day to the literature's content and themes (e.g., the phenomenon of migration during The Great Depression and Steinbeck's novel *The Grapes of Wrath* might be studied simultaneously and linkages made). A more recent attempt at interdisciplinary instruction has taken the form of the "literacy across the curriculum" movement. The goal here is to teach reading and writing within the context of the subject matter so as to assist the students to apply expert-like literacy strategies that are domain specific.

work in the narrative domain with pre-school and elementary school children. Here, the approach suggests a utilization of (a) language (i.e., conceptual labels) coupled with a graphic display that forms a conceptual mnemonic, (b) a flexible methodology, and (c) students' conceptual frameworks.

(a) Language and graphic mnemonics. Our concept-specific methodology uses an instructional dialogue between students and teacher. Specifically, the children communicate the meaning they take from instructional events to the teacher who, in turn, makes clear his or her understanding of children's spontaneous conceptual understanding by labeling the components of the structure. By way of example, the elements of narrative structure the 6-year-old are identified concisely by the teacher as "feeling bad or sad", "an idea to get feeling better", and "feeling happy again." These labels are coupled with graphic depictions so as to provide the children with a conceptual mnemonic that assists them in becoming aware of their current, spontaneous representation (see Figure 2). The conceptual mnemonics are central to the instruction process as they allow students to take a meta-position to their knowledge, and in so doing take as "object" that to which they were previously "subject" (Kegan, 1982).

Language that refers to central concepts is also essential in the next step in the instruction process, that is, conveying a new set of semantic relations inherent in the more advanced conceptual structure. By way of example, the 8-year-old narrative structure has

one structural element added to the 6-year-old structure, that is, an idea that doesn't work (again, see Figure 2). Here, the dialogue is initiated by the teacher, who identifies the new element and shows how it relates to the components of the previous structure, as it is displayed in the graphic representation. The conceptual labels, used in conjunction with a graphic display, help the students apply the newly acquired structure across situations. This is because they are specific enough to capture the conceptual essence of the material yet general enough to be applied across a range of tasks that differ in surface features but share the same underlying pinning.

(b) Flexible Methodology. Student-teacher interaction is not the only approach used. In contrast to the rather didactic process described above, instruction can be initiated through peer teaching. Here again, dialogues form the basis of the exchange. Students who participate in "communities of learners" develop an understanding of their classmates' concepts or "theories" and, in turn, communicate their own point-of-view to class members. As can be seen, then, in addition to internally-situated processes, such as exploration and problem solving, the current approach also taps into socially-situated learning processes, typically associated with the socio-cultural school of thought (Brown & Campione, 1984; Bruner, 1987; Vygotsky, 1978; Wertsch, 1991). Thus, the present approach allows teachers to be flexible in their use of methodology, including didactic methods as well as peer-centered learning.

(c) The student's conception. What the two approaches described above have is common is their focus on the conceptual understanding

of the student. Although the peer dialogues results in more open-ended discussion than teacher-initiated conceptual change, both approaches share the notion that discussion of conceptual representations is central to learning and that, through such discussions, existing knowledge structures are examined and new elements are added to them. Thus, both teacher-student dialogues and the peer dialogues are thought of as a "mutual regulation" process, as teacher, student, and peer are affected by the representation held by the other.

When should material be taught? The current approach also allows teachers to make decisions regarding the timing of instruction on the basis of students' conceptual understanding. Within the current model, students are asked to apply a given structure independently only when that structure is firmly in place. Otherwise, conceptual support is offered in the form of instructional dialogues between student and teacher and among fellow students. With a clear picture of the developmental sequence in hand, teacher are in a good position to judge (a) if the students have mastery of a given central concept and (b) what new structural component should be introduced. Thus, in contrast to the Piagetian-based approach, programs of instruction based on central conceptual structures are in the hands of teachers.

Conclusion. At the outset of this paper I proposed that curricula designed to teach central conceptual structures offer a new conceptualization of curriculum design and delivery. I will conclude my discussion by comparing the current approach with others that

have influenced practice and highlight its potential utility in addressing practical curricula-related problems currently facing teachers.

The present approach clearly represents a move away from the Piagetian notion of a content-free, single, logical structure. In advocating that instruction should focus on the elements of the central conceptual structures and the relations among them, we are suggesting that the organization of the mind is indeed more domain specific than Piaget postulated. Thus, curricula are not aimed at affecting academic performance at a global level, but rather focus on material that has direct relevance to specific subject matter. At the same time, however, because the knowledge structures are considered central to a range of traditional disciplines, the current approach is aimed forming interdisciplinary linkages. Consequently, it occupies a middle ground, between the subject-area specificity and global knowledge structures, where the semantic relations inherent within the children's central conceptual structures are taught.

Given this intermediate position, curricula based on central conceptual structures utilize teaching methodologies both from a traditional developmental approach and from a subject-area orientation. That is, while we retain the view that children construct increasingly complex conceptual representations, we posit that the assembly can be assisted by direct concept-specific instruction. Thus, the current approach can tolerate a range of methodological approaches such that teachers' individual teaching preferences can be accommodated.

Finally, central conceptual curricula offers a potentially useful framework for responding to issues that are presently of critical importance in the field, such as "program continuity" and "assessment standards." Over the last ten years, data have been massed that clearly indicate that retention has not produced the expected results. Studies have repeatedly shown that students who are retained fair no better than matched peers who are promoted (Melvin & Juliebo, 1991). In reaction to these findings, "program continuity" or "continuous progress" has been suggested. Currently, practitioners are struggling with how to operationalize the construct in a graded system. The issue is further complicated by a lack of knowledge of assessment standards. As was demonstrated in the second paper, the present developmental theory offers a possible framework for judging students' performance in terms of their level of understanding, as it is demonstrated within a central conceptual domain. Moreover, the developmental progression, with its hierarchical organization in each domain provides a potentially useful framework for the notion of continuous (rather than graded) progress.

In closing, we see our central conceptual approach as a natural companion to instructional approaches that are designed to have children reflect on their own understanding and examine how to go about acquiring new knowledge (Bereiter & Scardamalia, 1983). Like these approaches, the current framework transcends subject-area disciplines and aims at intermediate level structures, between domain-specific and global knowledge.

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	Relational Stage (2 -4 years)	**Dimensional Stage** (5 -11 years)	**Vectorial Stage** (12 -18 years)
Social Structure	Action Event Structure	Intentional Structure	Interpretive Structure
	sequence of physical events and states (I do "A" and then I do "B")	events and states in physical world are differentiated from but related to mental states (I do "A" & "B" because I feel/think "X" & "Y")	mental states are related to character's psychological makeup (I feel/think "X" & "Y" because I am a certain type of person)
Story Structure	1st order event structure (Script)	2nd order event structure (Simple plot of folktale)	3rd order event structure (Complex plot of short story)
	time line reporting of event sequence; action and feeling are melded	episodic organization centering on a problem and its resolution; event is problematic because of the mental state it engenders	Literary techniques (e.g., foreshadowing or flashback) provide meta-perspective to characters' actions and mental states resulting in romance, satire, comedy, or tragedy

Figure 1 The Central Social Structure